Geophysical Research Abstracts
Vol. 15, EGU2013-8597, 2013
EGU General Assembly 2013

A helium isotope cross-section study through the Vulture line, southern Apennines

Antonio Caracausi (1), Mauro Martelli (1), Mario Nuccio (1), Michele Paternoster (2), and Finlay Stuart (3)

(1) Istituto Nazionale di Geofisica e Vulcanologia, INGV-Section of Palermo, Palermo, Italy (caracau@pa.ingv.it), (2) Dipartimento di Scienze,Universita'della Basilicata, Campus Macchia Romana, 85100 Potenza, Italy, (3) Isotope Geosciences Unit, Scottish Universities Environmental Research Centre, East Kilbride G75 0QF, UK

We report the results of a geochemical study of gas emissions and spring waters collected along a NE–SW transect through the southern Apennines in order to quantify the contribution of mantle-derived helium in crustal fluids and consequently to evaluate the existence of a structural discontinuity (the "Vulture line"). This tectonic discontinuity is interpreted as N40°–50° trending deep fault, cutting the entire chain-foreland system in southern Apennines (Schiattarella et al., 2005). The lithospheric discontinuity was generated by variation in the velocity of subduction rollback along the length of the subducting plate and has generated a vertical slab window (i.e. Doglioni et al., 1994; D'Orazio et al., 2007), that is responsible for the origin of Mt. Vulture volcano.

Mount Vulture is the eastern-most occurrence of the Quaternary Italian volcanism, and is the only volcano to the east of the Apennine mountain belt. Its volcanic activity started at 742±11 kyr and continued until 142±11 kyr, interrupted by several long inter-eruptive periods (Buettner et al., 2006, and references therein). The volcanism is strongly silica undersaturated, from alkaline potassic to ultrapotassic affinities. We investigated lavas from the Mt. Vulture displaying 3He/4He (up to ∼6.0 Ra) and Sr isotopes that are consistent with an origin in mantle that has had minimal pollution from subducted Adriatic slab. This value is rather constant along the history of the volcano, and represent the highest helium isotope signature of the Italian peninsular magmatism even if it is slightly lower than that of the most uncontaminated Sicilian terms. Similar 3He/4He in fluids from around Mt. Vulture indicate that the deep volcanic system is still degassing.

The 3He/4He of the investigated fluids along the NE–SW transect of the Vulture line highlights that degassing of mantle-derived helium occur from the Apulian foreland to the Tyrrhenian sea. The highest contribution of mantle-derived fluids is present at Mt. Vulture volcano and the surrounding area, while it decreases toward the Tyrrhenian sea. This may be due to different causes: a) volatiles degassing from near-surface melts beneath Mt. Vulture are quantitatively dominant with respect to crustal gases, in contrast to gas emissions located close to the peri-Thyrrenian area and/or b) the 3He/4He of the peri-Tyrrhenian magmas is expected to be lower than 6 Ra.

Our data suggest the active role of Vulture line (lithospheric faults) to transfer towards the surface mantle-derived fluids from magmatic bodies or from asthenospheric upwelling of hot, possible molten material (Ökeler et al., 2009) accumulated to the base of the crust.

Buettner, A., Principe, C., Villa, I.M., Bocchini, D., 2006. 39Ar–40Ar geochronology of Monte Vulture. In: Principe, C. (Ed.), La Geologia del Monte Vulture. Grafiche Finiguerra, Lavello, Italy, pp. 73–86.

Doglioni, C., Mongelli, F., Pieri, P., 1994. The Puglia uplift (SE Italy): an anomaly in the foreland of the Apenninic subduction due to buckling of a thick continental lithosphere. Tectonics 13 (5), 1309–1321.

D'Orazio, M., Innocenti, F., Tonarini, S., Doglioni, C., 2007. Carbonatites in a subduction system: the Pleistocene alvikites from Mt. Vulture (southern Italy). Lithos 98, 313–334.

Ökeler, A., Gu, Y.J., Lerner-Lam, A., Steckler, M.S., 2009. Seismic structure of the southern Apennines as revealed by wave form modelling of regional surface waves. Geophysical Journal International 178, 1473–1492.

Schiattarella, M., Beneduce, P., Giano, S.I., Giannandrea, P., Principe, C., 2005. Assetto strutturale ed evoluzione morfotettonica quaternaria del vulcano del Monte Vulture (Appennino Lucano). Bollettino della Societa Geologica Italiana 124, 543–562.